nition of the work of others. Writing for general as well as for scientific readers, he has ventured to set a standard of intellectual integrity quite unusual in popular works. I believe the general reader will appreciate the innovation. The author has further maintained a fine impartiality of statement. Few of us, doubtless, would have used exactly the same material. All must recognize the candor of his selections and his effort to discover the points of advance.

It is obvious from the nature of the contents that the different parts of the book must represent very different degrees of scientific assurance. Of this the author himself is thoroughly aware. Our present experimental knowledge of the reading of children does not warrant the psychological investigator in giving the weight of his investigations to any system of teaching reading, to any selection of material, or to any definite answer to the questions when, or how much. For the sake of psychology as well as for the sake of a possible science of experimental pedagogy, it seems prudent to make a sharp distinction between the results of scientific experiment and the empirical generalizations of educators. No other science has so many poor relatives urging extravagance. Probably in no other science is there greater need of guarding our work against premature popular exploitation and misrepresentation. Since many of the processes of adult reading are still imperfectly understood, while accurate knowledge of the reading of children and its development is conspicuously fragmentary, it seems probable that school methods in reading must rest, for the present at least, on empirical generalization rather than on scientific law. This, however, is the opportunity of experimental science rather than its reproach. The reviewer joins with the author in the hope that the present work will not only indicate possible lines of attack, but will also stimulate to renewed and if possible coordinated investigation.

Meantime it seems clear that the success or failure of any method rests quite as much on the insight of the teacher into the mental life of his pupils as on any of the formal details of his method. I believe that an adequate knowledge of the mental organization he is supposed to develop, as well as of the material and mental conditions of its realization, is one of the invaluable factors of a teacher's equipment. This factor it is the present privilege of the experimental psychologist to increase. On these grounds I venture the conviction that the book as a whole and in its several parts is an unusual contribution to pedagogical literature. I believe it should be in the hands of every teacher of reading. But the psychologist will welcome its careful summaries and its broad outlook as heartily as the teacher will welcome the new insight into the processes with which he must deal.

The book brings together an immense amount of material in unusually readable form. It seems destined to arouse interest and stimulate investigation in an important field.

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SCIENTIFIC JOURNALS AND ARTICLES

THE contents of the June issue of *Terrestrial Magnetism and Atmospheric Electricity* are as follows: Portrait of E. van Rijckevorsel (frontispiece); "Magnetic Declination and Latitude Observations in the Bermudas," by J. F. Cole; "On Earth-currents and Magnetic Variations," by L. Steiner; "Return of the *Galilee* and Construction of a Special Vessel," by L. A. Bauer; "Magnetic Observations by the New Zealand Expedition to the Southern Islands," by H. F. Skey; "The Earth's Residual Magnetic Field," by A. Tanakadate, L. A. Bauer; "Biographical Sketch of E. van Rijckevorsel." Letters to Editor: "The Solar Eclipse of August 30, 1905, and Magnetic Phenomena," by C. Chree; "Regarding the Magnetic Effects of the Total Solar Eclipse of August 30, 1905," by Ch. Nordmann; "Principal Magnetic Storms recorded at the Cheltenham Magnetic Observatory (January–March, 1908)," by O. H. Tittmann. "Recent Determinations of the Solar Constant of Radi-

ation," by C. G. Abbott and F. E. Fowle, Jr. Notes: "Activity in Magnetic Work"; "Personalia." Abstracts and Reviews: W. van Bemmelen on "Registration of Earth-currents at Batavia," by L. Steiner; Cirera et Barcells on "Activité solaire et les perturbations magnétiques," by J. A. Fleming; Meyermann on "Korrektion der Reduktionsconstanten eines magnetischen Theodoliten," by J. A. Fleming. List of Recent Publications.

THE LIQUEFACTION OF HELIUM

INFORMATION communicated by Sir James Dewar to the London *Times* from Professor Kamerlingh Onnes, of Leiden, shows that helium is a liquid having a boiling point of 4.3 degrees absolute, which is not solid when exhausted to a pressure of ten millimeters of mercury, at which pressure the temperature must have been reduced to within three degrees of the absolute zero—*i. e.,* about one fourth of the temperature of hydrogen in corresponding conditions, as that again is about one fourth of the corresponding nitrogen temperature. If we could obtain another similar drop by the discovery of a gas still more volatile than helium we should have a liquid boiling about one degree above the absolute zero. The *Times* also gives a few notes upon the steps by which the liquefaction of helium has been reached. In 1895, by the application of the method of sudden expansion from high compression, Olscevski, starting from the temperature of exhausted air, failed to get any appearance of liquefaction. In 1901, Dewar, in the Bakerian lecture, described his repetition of that experiment, using liquid hydrogen under exhaustion instead of liquid air, again without obtaining any trace of condensation. Reasoning from the analogy of his experiments on the liquefaction of hydrogen, he showed that by regenerative cooling starting from the temperature of liquid hydrogen, we might expect to liquefy a gas whose boiling point might be as low as four or five degrees absolute. In his presidential address to the British Association in the following year he gave reasons for placing the boiling point of helium at that figure, showing at the same time how great are the experimental difficulties of getting within five degrees of absolute zero. In 1905 Olscevski repeated Dewar's experiment of 1901, using higher pressures, and reached the conclusion that the boiling point of helium must be below two degrees absolute, and that after all the gas might be permanent. The same experiment was repeated early in 1908 by Professor Onnes with a much larger quantity of helium than had previously been available, and he at first thought he had obtained solid helium, but found that the appearance was due to impurity in the gas. Dewar again repeated the experiment by circulating helium in a regenerative apparatus, but though he got cooling, he was baffled by the inadequacy of his supply of helium to maintain the cooling process sufficiently long to reach liquefaction. At last, by the experiment of July 10, Professor Onnes has definitely settled the matter. As new and richer sources of helium have been discovered, and its separation has been enormously facilitated by Dewar's charcoal method, it is possible that helium may become sufficiently abundant in cryological laboratories to be used as liquid hydrogen is now used in physical research.

SPECIAL ARTICLES

ELECTROMAGNETIC MASS

THE variations of meaning attached to d'Alembert's principle, that depend upon what we may call the genesis of the terms involved in its expression, has been insisted upon in a previous article.[1] We find a similar double chance open for instructive interpretation in many other equations of theoretical physics, among which we now select that important result in hydrodynamics which may be regarded as furnishing the original suggestion of "electromagnetic mass." For a solid of mass m moving in the line X through an ideal liquid free from boundary conditions, the familiar power equation is

$$Xu = d/dt\left(\tfrac{1}{2}mu^2 + \tfrac{1}{2}m_1u^2\right). \qquad (1)$$

Here X denotes the aggregate of force *external to the system* consisting of m and the

[1] SCIENCE, Vol. XXVII., p. 154.